REMARKS

Reconsideration and withdrawal of the rejections set forth in the Office Action dated September 23, 2004 are respectfully requested.

I. Amendments

In response to the objection to claim 1, duplicate occurrences of the word "the," have been deleted to overcome this objection. Claims 12 and 19 have been amended to clarify an aspect of the invention as revised in these claims. Several typographical errors were also corrected.

II. Rejections under 35 U.S.C. § 103

A. The Applied Art

Claims 1, 6-9, 12, 16, and 19-21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Wells.

Claims 2-4, 13, and 15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Wells in view of Barnes.

Claims 10, 11, 17, and 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Wells in view of Gethner et al.

Wells is directed to a method of speeding up analysis of components in gas chromatography (GC). Under Wells, a gas is provided to a column 14, which separates components as the gas travels through the column. The output of the column is provided to a ion cyclotron resonance (ICR) cell 20. An ionizing beam of electrons is injected into the cell, and the ions that form depend on substances in the cell, namely gases from the column 14. A voltage pulse having properties to excite ions in the cell is provided to opposing cell plates. The ions in the cell absorb radio frequency (RF) power from the pulse and induce current signals, which the cell outputs to an amplifier 30. An amplified signal output from the amplifier is then filtered, converted to digital form, and input to a computer. Under Wells, the computer can avoid Fourier transform (FT) computations, but instead operate on the digitized signal in only the time domain (as opposed to the frequency domain using FT).

In contrast, the applicant's technology is directed to a system for detecting a selected material in a sample by detecting very low amplitude electromagnetic signals produced by the sample itself via a detector coil placed next to the sample, when noise is introduced into the sample as external energy. Through Stochastic resonance, the low amplitude signals from the sample may be detected. In general, all matter capable of certain modes of molecular motion produces very low level electromagnetic emissions that may be detected by the applicant's system. In particular, electromagnetic signals emitted from the sample are stored as a time domain signal. This signal is then converted, such as digitized, and input to a computer for further signal conditioning. The computer "cross-correlates" or compares the signal with stored data signals to produce a frequency-domain spectrum or otherwise identify common frequency components. The computer may then determine whether the frequency-domain spectrum contains signal components characteristic of a selected material.

The cross-correlation may be performed by a microprocessor, digital signal processor (DSP), or monolithic processor chip, programmed to perform Fourier correlative analysis of the detected signal as compared to Fourier data of a stored and known signal. See, e.g., Application, p. 11. In other words, the system obtains a time-domain signal, and then compares a frequency domain representation of that signal with stored frequency-domain signals to identify whether a sample contains a selected material.

B. Analysis

As noted above, Wells operates on a time-domain signal, rather than operating in the frequency domain. Wells performs no "cross-correlating" to "produce a frequency-domain spectrum" from a signal produced from a sample. For example, column 6, lines 42-53 of Wells note that the correlation or comparison of signals is done in the time domain. The Office Action cites to column 7, lines 1-5 of Wells, but this portion of Wells describes comparing time-domain signals, not frequency-domain signals as in the claimed invention.

Possibly more importantly, Wells teaches away from analyzing signals in the frequency domain. For example, column 2, lines 57-62 explain that "by directly comparing the time domain signal output from the sample cell with time domain data from a known standard, one can . . . forego FT analysis." (As is known, Fourier transformation (FT) converts a time domain signal to a frequency domain signal.) Other references to avoiding FT or frequency domain analysis are found in Wells (see, e.g., Abstract; column 6, lines 20-23).

Another important distinction between Wells and the applicant's technology is that Wells employs ion cyclotron resonance (IRC) gas chromatography (GC). Under the IRC form of GC, a sample is vaporized or turned into a gas, and that gas is then ionized. Applicant's technology, instead, avoids such expensive and destructive techniques, and instead can pick up low-level electromagnetic signals or radiation from a sample. In particular, the invention of claim 1 employs a detector assembly that includes a "detector coil adjacent the sample holder." While the Office Action identifies parts 10 of Figure 2 in Wells as a "detector coil," this part is instead a GC column (see, e.g., column 6, lines 32-35). Such a column is not a detector coil. Possibly more importantly, the column of Wells requires the gas to travel through the column; the claimed invention requires the sample only be placed adjacent the coil.

Additional differences exist between Wells and the claimed invention. For example, the invention of claim 1 employs both signal conditioning components that remove selected frequency components, as well as an electronic computer that performs filtering to selectively pass low-frequency spectral components. Wells employs only a single filter 32 for processing the sample signal.

Furthermore, the claimed system generates signals from a sample thorough Stochastic resonance, by introducing noise into the sample region. This method of analyzing a sample can be non-destructive, as opposed to gas chromatography under Wells, which requires ionizing or vaporizing the sample.

The remaining independent claims 12 and 19 recite similar limitations. For example, claim 12 recites placing the sample adjacent a detector coil and detecting an electromagnetic time-domain signal from the sample. Likewise, claim 19 recites means

for holding the sample adjacent a detector coil to generate an electromagnetic time-domain signal composed of sample source radiation. Further, these claims recite introducing noise into the sample during signal generation.

Claim 12 recites two filtering steps, including conditioning the time-domain signal whereby frequency components above a selected frequency have been removed, as well as filtering the conditioned time-domain signal to selectively pass low-frequency spectral components. Claim 19 recites similar means for performing these functions. Further, claim 12 recites cross-correlating the filtered signal with a data set of "low-frequency spectral components" (i.e., frequency domain signals), while claim 19 recites means for similarly cross-correlating the filtered signal. As noted above, cross-correlation corresponds to conversion and analysis of signals in the frequency domain; Wells not only performs all analysis in the time-domain, but also teaches away from analysis in the frequency domain.

To further distinguish from Wells, claim 19 now recites that the means for holding the sample adjacent a detector coil to generate an electromagnetic time-domain signal is done without gas chromatography or ion cyclotron resonance. The claimed invention avoids drawbacks of gas chromatography and ion cyclotron resonance. As explained in Wells, mixtures of chemical compounds are separated as they travel through the column in gas chromatography (column 1, lines 14-19), and an electron beam ionizes the sample in the cell in ion cyclotron resonance (column 3, lines 24-27).

III. Conclusion

Overall, none of the applied references, singly or in any motivated combination, teach or suggest the features recited in independent claims 1, 12 and 19, and thus such claims are allowable. Since these independent claims are allowable, based on at least the above reasons, the claims which depend from them are likewise allowable. If the undersigned attorney has overlooked a relevant teaching in any of the references, the Examiner is requested to point out specifically where such teaching may be found.

In view of the foregoing, the claims pending in the application comply with the requirements of 35 U.S.C. § 112 and patentably define over the applied art. A Notice of Allowance is, therefore, respectfully requested. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to call the undersigned at (206) 359-3599.

Respectfully submitted,
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